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[Claim(s)]

[Claim 1] In the aluminum alloy clad material which carried out the clad of the aluminum alloy brazing material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other fields Sacrificial anode material contains the element which combines with aluminum and generates a **** compound from the matrix of sacrificial anode material. consisting of aluminum alloys which consist of the remainder aluminum and an impurity -- the inside of a matrix -- particle diameter (a circle equivalent diameter --) Said 1-10 same micrometers compound is 1mm2 below. Hit 5x102 to 5x104 Aluminum alloy clad material for heat exchangers excellent in the corrosion resistance characterized by ******(ing).

[Claim 2] The aluminum alloy clad material for heat exchangers excellent in the corrosion resistance according to claim 1 characterized by the compound which exists in the matrix of sacrificial anode material being a compound of one sort or two sorts or more of elements of Fe, nickel, Si, Mn, and the Co(es), and aluminum.

[Claim 3] Sacrificial anode material is Si. : 0.5 to 1.0% (it is below the sameweight %), Mn: 0.5 to 2.0%, Fe: 0.5-1.5%, nickel:0.3-1.5%, Co: The aluminum alloy clad material for heat exchangers excellent in the corrosion resistance according to claim 2 characterized by containing 1 of 0.3 to 1.5% of sorts, and two sorts or more, and consisting of the remainder aluminum and an impurity.

[Claim 4] Sacrificial anode material further Zn:0.5-5.0%, In:0.01-0.3%, Sn: 0.01-0.1%, Mg: The aluminum alloy clad material for heat exchangers excellent in the corrosion resistance according to claim 3 characterized by containing 1 of 2.5% or less (it being below the same excluding 0%) of sorts, and two sorts.

[Claim 5] Sacrificial anode material further Less than Be:0.1%, B:0.1% or less, and less than Ca:1.0% V:0.1% or less, less than Cr:0.3%, less than Bi:0.1%, less than Ti:0.3%, Zr: The aluminum alloy clad material excellent in the corrosion resistance according to claim 3 to 4 characterized by containing 1 of 0.3% or less of sorts, and two sorts or more.

[Claim 6] In the aluminum alloy clad material which carried out the clad of the aluminum alloy brazing material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other fields Sacrificial anode material contains less than Mg:2.5% Si:0.5-1.0%. It consists of aluminum alloys which consist of the remainder aluminum and an impurity, and is Mg2 [with a particle diameter of 1-10 micrometers] in the matrix of this aluminum alloy. Si grain is 5x102 to 5x104 per mm2. Aluminum alloy clad material for heat exchangers excellent in the

corrosion resistance characterized by ******(ing).
[Claim 7] Sacrificial anode material further Zn:0.5-5.0%, In:0.01-0.3%, Sn: 0.01-0.1%, Be : 0.1% or less, B:0.1% or less, Ca: Less than 1.0%, V:0.1% or less, less than Cr:0.3%, less than Bi:0.1%, less than Ti:0.3%, Zr: The aluminum alloy clad material excellent in the corrosion resistance according to claim 6 characterized by containing 1 of 0.3% or less of sorts, and two sorts or more.
[Claim 8] The aluminum alloy clad material excellent in the corrosion resistance according to claim 1 to 7 characterized by a core material consisting of an aluminum alloy of an aluminum-Mn system or an aluminum-Mn-Cu system.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] the aluminum alloy clad material for heat exchangers this invention excelled [aluminum alloy clad material] in corrosion resistance -- detailed [with inert gas atmosphere soldering or vacuum soldering using the fluoride system flux] When heat exchangers made from aluminium, such as a radiator for automobiles and a heater core, are manufactured, Are applicable as the tube material (welded tube of a clad plate) which is the architecture member, line material (extrusion clad tube) connected to a heat exchanger, etc. It is related with the aluminum alloy clad material for heat exchangers which offered the corrosion resistance which was excellent to the alkali corrosion nature environment by Courant usually especially used in the heat exchanger concerned.
[0002]
[Description of the Prior Art] As tube material, such as a radiator for automobiles, and a heater core, and header plate material, The clad of the aluminum-Si system brazing material is carried out to one side of the core material which consists of aluminum-Mn system alloy, such as 3003 alloy, and the aluminum alloy clad material of three layers which carried out the clad of aluminum-Zn system alloy or the aluminum-Zn-Mg system alloy is used for other fields as sacrificial anode material.
[0003] In the aluminum alloy clad material concerned, an aluminum-Si system brazing material is prepared for joining to the tube material and fin material which are performed by inert gas atmosphere soldering or vacuum soldering which uses the fluoride system flux, and joining to tube material and header plate material. When assembled by heat exchangers made from aluminium, such as a radiator and a heater core, sacrificial anode material touches a working fluid, and it is prepared in order to demonstrate a sacrificial anode effect to a working fluid and to prevent pitting of a core material, and crevice corrosion.
[0004] Moreover, the clad tube of two-layer or three layers which made the core material aluminum-Mn system alloy, such as 3003 alloy, and carried out the clad of the sacrificial anode material of aluminum-Zn system alloy, such as 7072 alloy, to the inner surface or the inner surface, and the outside surface as line material which connects between the heat exchangers for automobiles is used. The inner surface which carried out the clad of the sacrificial anode material touches a working fluid, a sacrificial anode effect is demonstrated to a working fluid, pitting and crevice corrosion of a core material are prevented, and an outside surface prevents pitting and crevice corrosion of a core material

which are produced when used in a severe environment.
[0005] Generally in these heat exchangers, it is Courant as a working fluid. Although the solution neutral [which diluted the antifreezing solution which makes the base the ethylene glycol marketed to 0-50vol% concentration with water] - weak alkaline is used Usually, there are many weak alkaline things among Courant, pitting which penetrates a core material to said aluminum alloy clad material from which around ten things also constitute [pH] a tube etc. by a working fluid depending on a class for a certain reason arises, and spoiling a heat exchange function is often experienced.
[0006] The combination of the component composition of a core material and the component composition of sacrificial anode material is examined, As a corrosion-resistant aluminum alloy clad material which raises pitting-proof nature and has the outstanding sacrificial anode effect A core material For example, Mn:0.3-2.0%, Mg:0.10-0.80%, Cu : Contain 0.05 to 0.50% and it constitutes from an aluminum alloy which consists of the remainder aluminum and an unescapable impurity. Zn:0.3-2.0% and Mg:0.1-2.5% are contained for the scum material by which the clad was carried out to the one side of the core material. It constitutes from an aluminum alloy which consists of the remainder aluminum and an unescapable impurity. Furthermore, in the scum material by which the clad was carried out to the other side of the core material, Si:7.0-15.0% and Mg:0.3-2.5% are contained, and the cladding material constituted from an aluminum alloy which consists of the remainder aluminum and an unescapable impurity is proposed. (JP,S62-45301,B) [0007] moreover -- in the aluminum alloy clad material of three layers which, on the other hand, looked the aluminum alloy brazing material like [one side of an aluminum alloy core], and carried out the clad of the sacrificial anode material to it As sacrificial anode material, Zn:0.5-3%, Ti:0.05-3%, Mg:0.1-5%, Si : 0.3 to 1.5% if needed Further little Sn(s), In, what uses the aluminum alloy which contains one sort in Ca and Li, or two sorts or more, and consists of the remainder aluminum and an unescapable impurity (JP,H5-239580,A) A core material Mn:0.3-2.0%, Cu:0.25-0.8%, Si:0.2-1.0%, Mg: Less than 0.5%, Ti : Contain 0.35% or less and it consists of aluminum alloys which consist of the remainder aluminum and an unescapable impurity. What consists of aluminum alloys with which sacrificial anode material contains Zn:0.5-2.0%, Mg:1.2-2.5%, and Si:0.2-0.8%, and consists of the remainder aluminum and an unescapable impurity (JP,H4-198447,A) It is proposed.
[0008] Although a working fluid demonstrates the outstanding sacrificial anode effect in the case of the solution which is low temperature comparatively and contains Cl ion with neutrality - weak acidity when these aluminum alloy clad materials are used as tube material of heat exchangers made from aluminium, such as a radiator and a heater core, etc., When working fluids are pH nine or more alkaline solutions, in addition, corrosion resistance is not enough, pitting arises, and an anticorrosive effect cannot be demonstrated in many cases.
[0009] In order to solve this problem, inventors are sacrificial anode material of a three-layer cladding material, Fe: 0.5-3.0%, nickel: 0.1 to 3.0% of one sort or two sorts were contained, and it proposed applying the aluminum alloy which added one sort of Mg, Zn, In, Sn, and Ga, or two sorts or more if needed further. (JP,H9-176768,A) Although this cladding material has offered the alkali-proof corrosion behavior which was excellent in the anticipated-use environment, when the environment becomes still severer, sufficient anti-corrosion effectiveness may not necessarily be acquired.

[0010] In the process in which inventors work on the cause and its cure against the pitting birth produced in the aluminum alloy clad material which carried out the clad of the sacrificial anode material into pH nine or more alkali solutions [a thing] although it found out previously that a through tube arose by the thick coat of the porosity which assumes brown - black on the surface of a sacrificial anode layer generating under alkali environment, and an attack's concentrating on the defective part of a coat, and carrying out a precedence attack Many coat defects are formed in the part where the compound particles in the matrix which exists on the surface of an ingredient barred the deposition of aluminium hydroxide which is a film component, and may control formation of a coat in as a result of performing an experiment and analyses furthermore, and coat formation was barred, and pitting is distributed. The knowledge of the ability to prevent birth of through tube foods was carried out.

[0011]

[Problem(s) to be Solved by the Invention] This invention is made based on the above-mentioned knowledge. The object is Cl at the case where corrosion resistance and the working fluid which is excellent in especially alkali-proof corrosion behavior, and has alkalinity are used, neutrality - weak acidity. - Also when the included solution is used, it is in offering the aluminum alloy clad material for heat exchangers which can prevent birth of the through tube by pitting.

[0012]

[Means for Solving the Problem] [the aluminum alloy clad material for heat exchangers excellent in the corrosion resistance by this invention for attaining the above-mentioned object] In the aluminum alloy clad material which carried out the clad of the aluminum alloy brazing material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other fields Sacrificial anode material contains the element which combines with aluminum and generates the **** compound of electric potential from the matrix of sacrificial anode material. It consists of aluminum alloys which consist of the remainder aluminum and an impurity, and said compound with a particle diameter of 1-10 micrometers is 1mm2 in a matrix. Hit 5x102 to 5x104 It is characterized [1st] by ******(ing).

[0013] Moreover, the compound which exists in the matrix of sacrificial anode material is a compound of one sort or two sorts or more of elements of Fe, nickel, Si, Mn, and the Co(es), and aluminum, And sacrificial anode material is Si. : 0.5 to 1.0%, Mn: 0.5 to 2.0%, Fe: 0.5-1.5%, nickel:0.3-1.5%, Co : 1 of 0.3 to 1.5% of sorts and two sorts or more are contained. It is characterized [2nd and 3rd] by consisting of the remainder aluminum and an impurity, and [sacrificial anode material] Furthermore, one sort in less than Mg:2.5% (it is below the same excluding 0%) or two sorts are contained Zn:0.5-5.0%, In:0.01-0.3%, and Sn:0.01-0.1%, Sacrificial anode material further And less than Be:0.1%, B:0.1% or less, Ca: Less than 1.0%, V:0.1% or less, less than Cr:0.3%, less than Bi:0.1%, less than Ti:0.3%, Zr: It is characterized [4th and 5th] by containing 1 of 0.3% or less of sorts, and two sorts or more.

[0014] Furthermore, it sets to the aluminum alloy clad material which carried out the clad of the aluminum alloy brazing material to one side of the core material which consists of an aluminum alloy, and carried out the clad of the sacrificial anode material to other fields. Sacrificial anode material contains less than Mg:2.5% Si:0.5-1.0%. It consists of aluminum alloys which consist of the remainder aluminum and an impurity, and is Mg2 [

with a particle diameter of 1-10 micrometers] in the matrix of this aluminum alloy. Si grain is 1mm2. Hit 5x102 to 5x104 It ******, To the aluminum alloy of the above-mentioned composition, further Zn:0.5-5.0%, In:0.01-0.3%, Sn: 0.01-0.1%, Be : 0.1% or less, B:0.1% or less, Ca: Less than 1.0%, V:0.1% or less, less than Cr:0.3%, less than Bi:0.1%, less than Ti:0.3%, Zr : 1 of 0.3% or less of sorts and two sorts or more are contained, And it is characterized [of this invention / 6th, 7th, and 8th] by a core material consisting of an aluminum alloy of an aluminum-Mn system or an aluminum-Mn-Cu system.

[0015] In this invention, sacrificial anode material contains the element which combines with aluminum and generates the **** compound of electric potential from the matrix of sacrificial anode material. It consists of aluminum alloys which consist of the remainder aluminum and an impurity, and is 1mm2 about the compound with a particle diameter of 1-10 micrometers concerned in a matrix. Hit 5x102 to 5x104 It is important to make it scatter by ** detailed. [in the part where the compound of the sacrificial anode material surface exists by considering it as such matrix description] Since the deposition of aluminium hydroxide which is a film component is barred, formation of a coat is controlled, a coat defect increases and pitting distributes, pitting will localize like [when there are few coat defects], it will not say that the progress to the depth direction becomes quick, and birth of through tube foods can be prevented. 1mm2 If the number of said compounds of a hit increases, self corrosion resistance will deteriorate.

[0016] When the meaning and its Reason for definition of an alloy content in the sacrificial anode material in this invention are explained, [Fe, nickel, Si, Mn, and Co] In a matrix, respectively An aluminum-Fe system compound, an aluminum-nickel system compound, In the location of the compound which is made to distribute minutely an aluminum-Fe-nickel system compound, an aluminum-Si-Mn system compound, an aluminum-Si-Fe system compound, an aluminum-Mn system compound, an aluminum-Co system compound, etc., and exists in a material-list side [as a result of barring the deposition of aluminium hydroxide which is a film component and controlling formation of a coat, the part serves as a coat defect and pitting arises, but] Since a coat defect exists around the compound currently distributed minutely, therefore the number is distributed mostly and uniformly, pitting is also distributed, an attack depth becomes shallow and a through tube is not produced.

[0017] [content / with each desirable component for generating and distributing the above-mentioned compound in the matrix of sacrificial anode material] The desirable inclusion range of Fe is 0.5 to 1.5%, and at less than 0.5%, if the effectiveness is small, and contained exceeding 1.5%, while the self-corrosion behavior of sacrificial anode material will increase, strip-processing nature falls. The still more desirable inclusion range of Fe is 0.7 to 1.2%. If the desirable inclusion range of nickel is 0.3 to 1.5%, its less than 0.3% is not enough as the effectiveness, and 1.5% is exceeded, while the self-corrosion behavior of sacrificial anode material will increase, strip-processing nature deteriorates. The still more desirable content of nickel is 0.7 to 1.2% of range.

[0018] The desirable inclusion range of Si is 0.5 to 1.0%, and at less than 0.5%, if the effectiveness is small, and contained exceeding 1.0%, while the self-corrosion behavior of sacrificial anode material will increase, strip-processing nature falls. The still more desirable inclusion range of Si is 0.7 to 1.0%. If the desirable inclusion range of Mn is 0.5 to 2.0%, its less than 0.5% is not enough as the effectiveness, and 2.0% is exceeded,

while the self-corrosion behavior of sacrificial anode material will increase, strip-processing nature deteriorates. The still more desirable content of Mn is 0.7 to 1.2% of range. If the desirable inclusion range of Co is 0.3 to 1.5%, its less than 0.3% is not enough as the effectiveness, and 1.5% is exceeded, while the self-corrosion behavior of sacrificial anode material will increase, strip-processing nature deteriorates. The still more desirable content of Co is 0.5 to 1.0% of range.

[0019] It coexists with Si, Mg2 Si is generated, the compound concerned distributes minutely in a matrix, and in the location of the compound which exists in a material-list side, Mg bars the deposition of aluminium hydroxide which is a film component, and controls formation of a coat. As a result, although the part serves as a coat defect and pitting arises, a coat defect exists around the compound currently distributed minutely, therefore since the number is distributed mostly and uniformly, pitting is also distributed, an attack depth becomes shallow and a through tube does not produce it. The desirable inclusion range of Mg is 2.5% or less, and when 2.5% is exceeded, the still more desirable content of Mg to which the self corrosion resistance of sacrificial anode material falls is 1.5% or less.

[0020] Zn, In, and Sn make electric potential of sacrificial anode material **, hold the sacrificial anode effect over a core material, and prevent pitting and crevice corrosion of a core material. The desirable content of Zn is 0.5 to 5.0% of range, its less than 0.5% is not enough as the effectiveness, and the self-corrosion behavior exceeding 5.0% falls. The still more desirable inclusion range of Zn is 1.0 to 2.5%. While the desirable content of In is 0.01 to 0.3% of range, its less than 0.01% is not enough as the effectiveness and the self-corrosion behavior exceeding 0.3% falls, strip-processing nature deteriorates. The still more desirable inclusion range of In is 0.01 to 0.05%. Moreover, while the desirable content of Sn is 0.01 to 0.1% of range, its less than 0.01% is not enough as the effectiveness and the self-corrosion behavior exceeding 0.1% falls, strip-processing nature deteriorates. The still more desirable inclusion range of Sn is 0.01 to 0.05%.

[0021] B, Ca, V, Cr, Ti, and Zr are the parts where aluminum and a compound are generated, fine dispersion of this is carried out into the matrix of sacrificial anode material, and the compound of a material-list side exists like above Fe, nickel, etc. While barring the deposition of aluminium hydroxide which is a film component and controlling formation of a coat, it functions as distributing pitting and preventing birth of through tube foods. If the range of desirable content is B:0.1% or less, less than Ca:1.0%, V:0.1% or less, less than Cr:0.3%, less than Ti:0.3%, and not more than Zr:0.3% and it exceeds an upper limit, respectively, the self corrosion resistance of sacrificial anode material and strip-processing nature will fall. In addition, less than Bi:0.1%, Be: Even if 0.1% or less contains, the engine performance of this invention cannot be affected, and a characteristic can also be improved, but if an upper limit is exceeded, self corrosion resistance and strip-processing nature will be injured.

[0022] In this invention, use the aluminum alloy of the above-mentioned composition as sacrificial anode material, and as a core material 0.3 to 2.0% of Mn or 0.3 to 2.0% of Mn, the aluminum alloy containing 0.1 to 1.0% of Cu, Or when it is used for this combining the aluminum alloy which added one sort of 0.5 more% or less of Mg, and 1.0% or less of Si, or two sorts, the especially excellent effectiveness can be acquired.

[0023]

[Embodiment of the Invention] After the aluminum alloy clad material for heat

exchangers of this invention carries out ingot making by semi-continuous casting and carries out homogenization disposal about a core material and sacrificial anode material, it hot-rolls the aluminum alloy which constitutes a core material, sacrificial anode material, and a brazing material by the given thickness if needed, respectively. It hot-rolls if needed also about a brazing material, and subsequently, each ingredient is combined, and it is considered as a cladding material with hot rolling according to a conventional method, and is manufactured through the process eventually cold-rolled by the given thickness.

[0024] In the manufacture process of a cladding material although said compound distributes in the matrix of sacrificial anode material The fine dispersion condition of this invention predetermined compound is acquired by adjusting the conditions of intermediate annealing performed in the middle of composition of the aluminum alloy which constitutes sacrificial anode material, the ingot homogenization processing condition of sacrificial anode material, the hot-rolling conditions of a cladding material, the degree of cold rolling working, and cold rolling. For example, compound dispersion of this invention can be obtained by setting the cooling rate of an ingot to s in 0.1 degree C/s - 100 degrees C /, not performing homogenization disposal, or performing homogenization disposal in a 400-500-degree C temperature region, and performing intermediate annealing after clad rolling at 200-400 degrees C. In addition, the particle diameter of the compound in sacrificial anode material carries out 5 field-of-view (0.15mm2 of area aggregates) photography of the 200-time-as many optical microscope photography as this, and is called for by measuring compound particle diameter (circle equivalent diameter) distribution with an image-analysis apparatus.

[0025] Manufacture a welded tube from the aluminum alloy clad material of this invention, and consider it as the tube material for heat exchangers, and as header plate material In using it for the assembly of heat exchangers made from aluminium, such as a radiator for automobiles, and a heater core, the fin material of an aluminum alloy is combined and it performs [be / it / under / soldering furnace / setting] inert gas atmosphere soldering using the fluoride system flux, or vacuum soldering.

[0026] Therefore, in the aluminum alloy clad material of this invention, the clad of an aluminum-Si system brazing material or the aluminum-Si-Mg system brazing material is carried out to one side of a core material. In this case, as an object for inert gas atmosphere soldering, aluminum-Si alloy which contains Si:6-13% fundamentally is applied, and the aluminum-Si-Mg alloy which contains Mg:0.5-3.0% further, for example is applied as an object for vacuum soldering. These aluminum-Si system brazing materials and an aluminum-Si-Mg system brazing material can also be made to contain one sort in less than Bi:0.1%, less than Be:0.1%, less than Ca:1.0%, and less than Li:1.0%, or two sorts or more.

[0027]

[Example]

By work-example 1 continuous casting, it is an aluminum alloy for core materials (JIS 3003 alloy-Mn:1.2%, Cu: 0.15%, Remainder aluminum, and impurity), Ingot making of the aluminum alloy for sacrificial anode material which has the composition shown in Tables 1-2, and the alloy for brazing materials (JIS BA4343-Si: 7.5%, Remainder aluminum, and unescapable impurity) was carried out. Homogenization disposal was performed about the ingot of the aluminum alloy for core materials, and the aluminum

alloy for sacrificial anode material, the ingot of the aluminum alloy for sacrificial anode material and the alloy for brazing materials was hot-rolled to predetermined thickness, and it hot-rolled combining the ingot of such rolled stock and the alloy for core materials, and was considered as the cladding material. Furthermore cold rolling and intermediate annealing were performed and 0.25-mm-thick clad plate material (H14) was produced by final cold rolling. 0.025mm (10% of rate of a clad) in thickness of a brazing material and the thickness of sacrificial anode material set thickness architecture of clad plate material to 0.025-0.060mm (10 to 24% of rate of a clad).

[0028]

[Table 1]

材料	組成(wt %)						
No	Si	Fe	Ni	Mn	Mg	Zn	その他
1	0.2	1.0	—	—	1.0	2.0	
2	0.2	0.72	—	—	—	1.8	
3	0.2	1.15	—	—	—	1.5	
4	0.2	0.51	—	—	1.0	1.2	
5	0.2	1.46	—	—	—	2.5	
6	0.2	0.3	1.0	—	1.0	2.0	
7	0.2	0.3	0.73	—	—	1.7	
8	0.2	0.3	1.15	—	—	1.5	
9	0.2	0.3	0.52	—	1.0	1.3	
10	0.2	0.3	1.46	—	—	2.5	
11	0.2	0.3	—	1.15	—	1.5	
12	0.2	0.3	—	0.51	—	1.0	
13	0.2	0.3	—	0.32	1.0	1.0	
14	0.2	0.3	—	1.8	—	2.5	
15	0.2	0.3	—	—	—	1.5	Co:0.7
16	0.2	0.3	—	—	1.0	0.5	Co:0.51
17	0.2	0.3	—	—	—	—	Co:0.9
18	0.2	0.3	—	—	—	1.0	Co:0.4
19	0.2	0.3	—	—	—	—	Co:1.4 In:0.02

[0029]

[Table 2]

材料 No	組成(wt %)						
	Si	Fe	Ni	Mn	Mg	Zn	その他
20	0.8	0.3	—	—	1.25	2.0	
21	0.51	0.3	—	—	2.5	1.5	
22	0.72	0.3	—	—	1.0	1.5	
23	0.95	0.3	—	—	0.5	1.5	
24	0.8	0.3	—	—	0.1	1.5	In:0.02
25	0.2	--	—	—	--	1.5	B:0.05
26	0.2	0.5	—	—	--	—	B:0.07 Bi:0.05 Sn:0.05
27	0.2	--	—	—	--	1.5	Ca:0.5
28	0.2	--	0.4	0.5	0.5	—	Ca:0.7 In:0.05 Sn:0.02
29	0.2	--	—	—	--	1.5	V:0.05
30	0.2	0.5	—	—	1.0	—	V:0.07 Be:0.05 Sn:0.05
31	0.2	--	—	—	--	1.5	Cr:0.15
32	0.2	0.3	0.3	0.3	0.5	1.5	Cr:0.25 In:0.02
33	0.2	--	—	—	--	1.5	Ti:0.15
34	0.2	1.0	—	—	1.0	1.0	Ti:0.25 Bi:0.05
35	0.2	--	—	—	--	1.5	Zr:0.15
36	0.2	--	1.0	—	1.0	1.0	Zr:0.25 Be:0.05
37	0.2	1.0	0.5	—	1.2	2.0	
38	0.5	1.0	—	—	1.2	2.0	
39	0.2	0.5	1.0	—	1.2	2.0	
40	0.2	1.0	—	—	1.2	—	In:0.02

[0030] The fluoride system flux is used without arranging a fin material for the obtained clad plate material, and it is 600 ** (material temperature) in nitrogen-gas-atmosphere mind. After cursing and heating to temperature, the corrosion test shown below was done.
[0031] Corrosion test 1: Use the etching fluid which diluted the commercial antifreezing solution to 30vol% concentration with distilled water, added caustic alkali of sodium, and was adjusted to pH 10 about the sacrificial anode material side, The cycle of having cooled and holding them 16h in temperature of 25 degrees C after 8h of sample boards are immersed into the etching fluid heated in temperature of 88 degrees C was repeated for four months.
[0032] Corrosion test 2: It is Cl about a sacrificial anode material side. - : 195 ppm, SO42 - : The water solution containing 60 ppm, 2+1 ppm of Cu(s), and Fe3+:30ppm is used as etching fluid, and after 8h is immersed into the etching fluid which heated the sample board in temperature of 88 degrees C, it cools. The cycle of holding 16h in temperature of 25 degrees C was repeated for three months.
[0033] The result of a corrosion test is shown in Tables 3-4. Each sample board according to this invention of strip-processing nature was good, and did not produce defects, such as a crack, and the maximum attack depth by the corrosion tests 1 and 2 showed the

outstanding corrosion resistance which does not amount to one third of board thickness, either by less than 0.1mm so that it might see in Table 3.

[0034]

[Table 3]

試験材	犠牲陽極材No	粒子径1-10μmの1mm²当たりの化合物の数	化合物系	最大腐食深さ(mm)	
				腐食試験1	腐食試験2
1	1	5 ×10⁶		0.03	0.05
2	2	1 ×10⁵	Al-Fe Al-Si-Fe	0.04	0.04
3	3	1 ×10⁴	(Fe_3Al AlFeSi	0.03	0.06
4	4	6 ×10³	等)	0.05	0.03
5	5	4 ×10⁴		0.03	0.07
6	6	5 ×10⁵		0.03	0.05
7	7	1 ×10⁵	Al-Ni	0.04	0.04
8	8	2 ×10⁴	(Al_3Ni Al_3Ni_2	0.03	0.06
9	9	6 ×10³	等)	0.06	0.03
10	10	3 ×10⁴		0.02	0.06
11	11	5 ×10⁵		0.04	0.07
12	12	2 ×10⁵	Al-Mn Al-Mn-Si	0.05	0.04
13	13	7 ×10³	(Al_6Mn AlMnSi	0.06	0.03
14	14	4 ×10⁴	等)	0.04	0.08
15	15	5 ×10³		0.04	0.06
16	16	1 ×10³	Al-Co	0.05	0.05
17	17	2 ×10⁴	(Co_2Al_9 等)	0.04	0.07
18	18	7 ×10³		0.07	0.04
19	19	5 ×10⁴		0.03	0.08

[0035]

[Table 4]

試験材	犠牲陽極材No	粒子径1-10μmの1mm²当たりの化合物の数	化合物	最大腐食深さ(mm)	
				腐食試験1	腐食試験2
20	20	5×10^{2}		0.04	0.05
21	21	1×10^{3}		0.06	0.04
22	22	6×10^{3}	Mg_2Si	0.04	0.05
23	23	2×10^{4}		0.07	0.03
24	24	5×10^{3}		0.04	0.06
25	25	6×10^{3}	Al-B	0.06	0.05
26	26	2×10^{4}	(AlB_2 等)	0.05	0.07
27	27	7×10^{3}	Al-Ca	0.06	0.05
28	28	1×10^{4}	(Al_4Ca等)	0.05	0.06
29	29	5×10^{3}	Al-V	0.05	0.04
30	30	3×10^{4}	(V_3Al 等)	0.03	0.07
31	31	4×10^{3}	Al-Cr	0.06	0.06
32	32	1×10^{4}	(Cr_2Al等)	0.05	0.08
33	33	4×10^{3}	Al-Ti	0.06	0.05
34	34	2×10^{4}	($TiAl$ Ti_3Al 等)	0.05	0.07
35	35	5×10^{3}	Al-Zr	0.05	0.04
36	36	1×10^{4}	(Al_3Zr Al_2Zr等)	0.04	0.07
37	37	3×10^{4}	Al-Fe Al-Ni Mg_2Si	0.03	0.04
38	38	5×10^{3}	Al-Fe Mg_2Si	0.02	0.04
39	39	4×10^{4}	Al-Fe Al-Ni Mg_2Si	0.03	0.03
40	40	5×10^{3}	Al-Fe Mg_2Si	0.02	0.04

[0036] By comparative example 1 continuous casting, ingot making of the aluminum alloy for sacrificial anode material, the same aluminum alloy for core materials as a work example 1, and the alloy for brazing materials of the composition shown in Tables 5-6 is carried out, and they are the same conditions as a work example 1, 0.25-mm-thick clad plate material (brazing-material thickness: 0.025mm, sacrificial anode stock thickness:0.025mm) It produced. About the obtained clad plate material, the sample board of the corrosion test was produced on the same conditions as a work example 1, and the same corrosion test as a work example 1 was done. A result is shown in Tables 7-8.

[0037]

[Table 5]

材料No	組成(wt %)						
	Si	Fe	Ni	Mn	Mg	Zn	その他
41	0.2	0.4	—	—	1.0	2.0	
42	0.2	1.8	—	—	—	1.8	
43	0.2	0.3	0.4	—	1.0	2.0	
44	0.2	0.3	1.8	—	—	1.7	
45	0.2	0.3	—	0.4	—	1.5	
46	0.2	0.3	—	2.5	—	1.0	
47	0.2	0.3	—	—	—	1.5	Co:0.2
48	0.2	0.3	—	—	1.0	0.5	Co:1.8
49	0.2	0.3	—	—	—	2.0	
50	1.2	0.3	—	—	2.5	1.5	
51	0.72	0.3	—	—	3.0	1.5	

[0038]
[Table 6]

材料No	組成(wt %)						
	Si	Fe	Ni	Mn	Mg	Zn	その他
52	0.2	—	—	—	—	1.5	B:0.2
53	0.2	—	—	—	—	1.5	Ca:1.2
54	0.2	—	—	—	—	1.5	V:0.2
55	0.2	—	—	—	—	1.5	Cr:0.5
56	0.2	—	—	—	—	1.5	Ti:0.5
57	0.2	—	—	—	—	1.5	Zr:0.5
58	0.2	1.0	—	—	1.2	0.2	
59	0.5	1.0	—	—	1.2	5.5	
60	0.2	1.0	—	—	1.2	—	In:0.5
61	0.2	1.0	—	—	1.2	—	Sn:0.5
62	0.2	1.0	—	—	1.2	—	Bi:0.2
63	0.2	1.0	—	—	1.2	—	Be:0.2

[0039]
[Table 7]

試験材	犠牲陽極材No	粒子径1-10μmの1mm²当たりの化合物の数	化合物	最大腐食深さ(mm)	
				腐食試験1	腐食試験2
41	41	3 ×10³	Al-Fe Al-Si-Fe	貫通	0.03
42	42	7 ×10⁴	〃 〃	0.03	貫通
43	43	3 ×10³	Al-Ni	貫通	0.03
44	44	7 ×10⁴	〃	0.02	貫通
45	45	3 ×10²	Al-Mn Al-Mn-Si	貫通	0.03
46	46	8 ×10⁴	〃 〃	0.04	貫通
47	47	2 ×10³	Al-Co	貫通	0.04
48	48	7 ×10⁴	〃	0.03	貫通
49	49	2 ×10³	Mg_2Si	貫通	0.02
50	50	7 ×10⁴	〃	0.05	貫通
51	51	8 ×10⁴	〃	0.05	貫通

[0040]
[Table 8]

試験材	犠牲陽極材No	粒子径1-10μmの1mm²当たりの化合物の数	化合物	最大腐食深さ(mm)	
				腐食試験1	腐食試験2
52	52	8 ×10⁴	Al-B	0.05	貫通
53	53	8 ×10⁴	Al-Ca	0.05	貫通
54	54	8 ×10⁴	Al-V	0.03	貫通
55	55	8 ×10⁴	Al-Cr	0.05	貫通
56	56	8 ×10⁴	Al-Ti	0.05	貫通
57	57	8 ×10⁴	Al-Zr	0.04	貫通
58	58	5 ×10³	Al-Fe Al-Si-Fe	0.03	貫通
59	59	6 ×10³	〃 〃	0.03	貫通
60	60	5 ×10³	〃 〃	0.03	貫通
61	61	5 ×10³	〃 〃	0.03	貫通
62	62	5 ×10³	〃 〃	0.03	貫通
63	63	5 ×10³	〃 〃	0.03	貫通

[0041] Sample board No.41 - 57 are 1mm2 of a compound with a particle diameter of 1-10 micrometers so that it may see in Table 7. Since the number of the hit had separated from the range of this invention, corrosion resistance was inferior and through tube foods occurred in the corrosion test 1 or the corrosion test 2. Since sample board No.58 - 63 had much content of In in sacrificial anode material, Sn, Bi, and Be, the self corrosion

resistance of sacrificial anode material was inferior, and through tube foods generated all in the corrosion test 2.

[0042]

[Effect of the Invention] According to this invention, corrosion resistance and the aluminum alloy clad material for heat exchangers excellent in especially alkali-proof corrosion behavior are offered. Especially this aluminum alloy clad material can be conveniently used as tube material, such as a radiator for automobiles, and a heater core, and header plate material.

[Translation done.]